

APPENDIX A4-A

TRANSIT RATE AND VOLUME GUIDELINES FOR ISOKINETIC SAMPLING

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The tables in Appendix A4-A apply to the first complete round-trip transit starting with an empty sampler container. **These tables are valid only if the sampler is emptied between verticals.**

Tables showing:

1. Isokinetic transit rates for a 1-liter bottle sampler with a
 - a. 3/16-inch nozzle
 - b. 1/4-inch nozzle
 - c. 5/16-inch nozzle
2. Isokinetic transit rates for a 3-liter bottle sampler with a
 - a. 1/4-inch nozzle
 - b. 5/16-inch nozzle
3. a. Minimum volumes for isokinetic sampling with a bag sampler
b. Isokinetic transit rates for a 3-liter bag sampler with a 1/4-inch nozzle
c. Isokinetic transit rates for a 3-liter bag sampler with a 5/16-inch nozzle

The designations in the **RATE** column of these tables are defined as follows:

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full The reeling or transit rate that fills the sampler to its maximum volume.
- 10 tip** The reeling or transit rate that will result in a volume in the sampler such that if the sampler nozzle is tipped 10 degrees down from the horizontal, no sample will spill from the nozzle.
- fastest** The reeling or transit rate that is the fastest rate to avoid compression problems in bottle samplers or to not exceed a transit rate that is more than 0.4 times the stream velocity for bag samplers.

The volume designations in these tables are defined as follows:

- max vol.** The volume that will be in the sampler when the "full" (see definition above) reeling rate or transit rate is used for the specified stream depth and velocity.
- 10 vol.** The volume that will be in the sampler when the "-10 tip" (see definition above) reeling or transit rate is used for the specified stream depths and velocity.
- min vol.** The volume that will be in the sampler when the "fastest" (see definition above) reeling or transit rate is used for the specified stream depth and velocity.
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APPENDIX A4-A—Table 1a. Isokinetic transit rates for a 1-liter bottle sampler with a 3/16-inch nozzle

[Transit rates in feet per second; Depth is (water depth) - (unsampled zone); max, maximum; vol, volume; min, minimum; mL, milliliter; --, not applicable]

| Depth (in feet) | Rate | Mean stream velocity in vertical (feet per second) | | | | | | | | | | | Max. vol. -10 vol. min. vol. | Volume- min. vol. (mL) | |
|-----------------------|---------|--|------|------|------|------|------|------|------|------|------|------|------------------------------------|------------------------------|-----|
| | | 1.50 | 2.00 | 2.50 | 3.00 | 3.50 | 4.00 | 4.50 | 5.00 | 6.00 | 7.00 | 8.00 | | | |
| 1 | full | 0.02 | 0.02 | 0.03 | 0.03 | 0.04 | 0.04 | 0.05 | 0.05 | 0.06 | 0.07 | 0.08 | 0.09 | 1,050 | 919 |
| 1 | -10 tip | 0.02 | 0.03 | 0.03 | 0.04 | 0.05 | 0.05 | 0.06 | 0.07 | 0.08 | 0.10 | 0.11 | 0.12 | 798 | 667 |
| 1 | fastest | 0.12 | 0.17 | 0.21 | 0.25 | 0.29 | 0.33 | 0.37 | 0.41 | 0.50 | 0.58 | 0.66 | 0.74 | 131 | -- |
| 2 | full | 0.03 | 0.04 | 0.05 | 0.06 | 0.07 | 0.08 | 0.09 | 0.10 | 0.12 | 0.14 | 0.17 | 0.19 | 1,050 | 807 |
| 2 | -10 tip | 0.04 | 0.05 | 0.07 | 0.08 | 0.10 | 0.11 | 0.12 | 0.14 | 0.16 | 0.19 | 0.22 | 0.25 | 798 | 555 |
| 2 | fastest | 0.13 | 0.18 | 0.22 | 0.27 | 0.31 | 0.36 | 0.40 | 0.45 | 0.54 | 0.63 | 0.72 | 0.81 | 243 | -- |
| 3 | full | 0.05 | 0.06 | 0.08 | 0.09 | 0.11 | 0.12 | 0.14 | 0.16 | 0.19 | 0.22 | 0.25 | 0.28 | 1,050 | 711 |
| 3 | -10 tip | 0.06 | 0.08 | 0.10 | 0.12 | 0.14 | 0.16 | 0.18 | 0.20 | 0.25 | 0.29 | 0.33 | 0.37 | 798 | 459 |
| 3 | fastest | 0.14 | 0.19 | 0.24 | 0.29 | 0.34 | 0.38 | 0.43 | 0.48 | 0.58 | 0.67 | 0.77 | 0.87 | 339 | -- |
| 4 | full | 0.06 | 0.08 | 0.10 | 0.12 | 0.14 | 0.17 | 0.19 | 0.21 | 0.25 | 0.29 | 0.33 | 0.37 | 1,050 | 628 |
| 4 | -10 tip | 0.08 | 0.11 | 0.14 | 0.16 | 0.19 | 0.22 | 0.25 | 0.27 | 0.33 | 0.38 | 0.44 | 0.49 | 798 | 376 |
| 4 | fastest | 0.15 | 0.21 | 0.26 | 0.31 | 0.36 | 0.41 | 0.46 | 0.51 | 0.62 | 0.72 | 0.82 | 0.93 | 423 | -- |
| 5 | full | 0.08 | 0.10 | 0.13 | 0.16 | 0.18 | 0.21 | 0.23 | 0.26 | 0.31 | 0.36 | 0.41 | 0.47 | 1,050 | 555 |
| 5 | -10 tip | 0.10 | 0.14 | 0.17 | 0.20 | 0.24 | 0.27 | 0.31 | 0.34 | 0.41 | 0.48 | 0.54 | 0.61 | 798 | 303 |
| 5 | fastest | 0.16 | 0.22 | 0.27 | 0.33 | 0.38 | 0.44 | 0.49 | 0.55 | 0.66 | 0.77 | 0.88 | 0.99 | 496 | -- |
| 6 | full | 0.09 | 0.12 | 0.16 | 0.19 | 0.22 | 0.25 | 0.28 | 0.31 | 0.37 | 0.43 | 0.50 | 0.56 | 1,050 | 490 |
| 6 | -10 tip | 0.12 | 0.16 | 0.20 | 0.25 | 0.29 | 0.33 | 0.37 | 0.41 | 0.49 | 0.57 | 0.65 | 0.74 | 798 | 238 |
| 6 | fastest | 0.17 | 0.23 | 0.29 | 0.35 | 0.41 | 0.47 | 0.52 | 0.58 | 0.70 | 0.81 | 0.93 | 1.05 | 561 | -- |

APPENDIX A4-A—Table 1a. Isokinetic transit rates for a 1-liter bottle sampler with a 3/16-inch nozzle—Continued

| Depth (in feet) | Rate | Mean stream velocity in vertical (feet per second) | | | | | | | | | | | Max. vol. -10 vol. min. vol. | Volume- min. vol. (mL) | |
|-----------------------|---------|--|------|------|------|------|------|------|------|------|------|------|------------------------------------|------------------------------|-----|
| | | 1.50 | 2.00 | 2.50 | 3.00 | 3.50 | 4.00 | 4.50 | 5.00 | 6.00 | 7.00 | 8.00 | | | |
| 7 | full | 0.11 | 0.14 | 0.18 | 0.22 | 0.25 | 0.29 | 0.33 | 0.36 | 0.43 | 0.51 | 0.58 | 0.65 | 1,050 | 432 |
| 7 | -10 tip | 0.14 | 0.19 | 0.24 | 0.29 | 0.33 | 0.38 | 0.43 | 0.48 | 0.57 | 0.67 | 0.76 | 0.86 | 798 | 180 |
| 7 | fastest | 0.18 | 0.25 | 0.31 | 0.37 | 0.43 | 0.49 | 0.55 | 0.62 | 0.74 | 0.86 | 0.99 | 1.11 | 618 | -- |
| 8 | full | 0.12 | 0.17 | 0.21 | 0.25 | 0.29 | 0.33 | 0.37 | 0.41 | 0.50 | 0.58 | 0.66 | 0.75 | 1,050 | 380 |
| 8 | -10 tip | 0.16 | 0.22 | 0.27 | 0.33 | 0.38 | 0.44 | 0.49 | 0.54 | 0.65 | 0.76 | 0.87 | 0.98 | 798 | 129 |
| 8 | fastest | 0.19 | 0.26 | 0.32 | 0.39 | 0.45 | 0.52 | 0.58 | 0.65 | 0.78 | 0.91 | 1.04 | 1.17 | 670 | -- |
| 10 | full | 0.16 | 0.21 | 0.26 | 0.31 | 0.36 | 0.41 | 0.47 | 0.52 | 0.62 | 0.72 | 0.83 | 0.93 | 1,050 | 292 |
| 10 | -10 tip | 0.20 | 0.27 | 0.34 | 0.41 | 0.48 | 0.54 | 0.61 | 0.68 | 0.82 | 0.95 | 1.09 | 1.23 | 798 | 40 |
| 10 | fastest | 0.22 | 0.29 | 0.36 | 0.43 | 0.50 | 0.57 | 0.65 | 0.72 | 0.86 | 1.00 | 1.15 | 1.29 | 759 | -- |
| 12 | full | 0.19 | 0.25 | 0.31 | 0.37 | 0.43 | 0.50 | 0.56 | 0.62 | 0.75 | 0.87 | 0.99 | 1.12 | 1,050 | 218 |
| 12 | -10 tip | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 12 | fastest | 0.24 | 0.31 | 0.39 | 0.47 | 0.55 | 0.63 | 0.71 | 0.78 | 0.94 | 1.10 | 1.25 | 1.41 | 832 | -- |
| 14 | full | 0.22 | 0.29 | 0.36 | 0.43 | 0.51 | 0.58 | 0.65 | 0.72 | 0.87 | 1.01 | 1.16 | 1.30 | 1,050 | 156 |
| 14 | -10 tip | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 14 | fastest | 0.26 | 0.34 | 0.43 | 0.51 | 0.60 | 0.68 | 0.77 | 0.85 | 1.02 | 1.19 | 1.36 | 1.53 | 894 | -- |
| 15 | full | 0.23 | 0.31 | 0.39 | 0.47 | 0.54 | 0.62 | 0.70 | 0.78 | 0.93 | 1.09 | 1.24 | 1.40 | 1,050 | 129 |
| 15 | -10 tip | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 15 | fastest | 0.27 | 0.35 | 0.44 | 0.53 | 0.62 | 0.71 | 0.80 | 0.89 | 1.06 | 1.24 | 1.42 | 1.59 | 922 | -- |

APPENDIX A4-A—Table 1b. Isokinetic transit rates for a 1-liter bottle sampler with a 1/4-inch nozzle

[Transit rates in feet per second; Depth is water depth - unsampled zone; max, maximum; vol, volume; min, minimum; mL, milliliter; --, not applicable]

| Depth (in feet) | Rate | Mean stream velocity in vertical (feet per second) | | | | | | | | | | | Max. vol. -10 vol. min. vol. | Volume- min. vol. (mL) | |
|-----------------------|---------|--|------|------|------|------|------|------|------|------|------|------|------------------------------------|------------------------------|-----|
| | | 1.50 | 2.00 | 2.50 | 3.00 | 3.50 | 4.00 | 4.50 | 5.00 | 6.00 | 7.00 | 8.00 | | | |
| 1 | full | 0.03 | 0.04 | 0.05 | 0.06 | 0.06 | 0.07 | 0.08 | 0.09 | 0.11 | 0.13 | 0.15 | 0.17 | 1,050 | 918 |
| 1 | -10 tip | 0.04 | 0.05 | 0.06 | 0.07 | 0.08 | 0.10 | 0.11 | 0.12 | 0.15 | 0.17 | 0.19 | 0.22 | 798 | 667 |
| 1 | fastest | 0.22 | 0.29 | 0.37 | 0.44 | 0.51 | 0.59 | 0.66 | 0.73 | 0.88 | 1.03 | 1.17 | 1.32 | 132 | -- |
| 2 | full | 0.06 | 0.07 | 0.09 | 0.11 | 0.13 | 0.15 | 0.17 | 0.18 | 0.22 | 0.26 | 0.29 | 0.33 | 1,050 | 806 |
| 2 | -10 tip | 0.07 | 0.10 | 0.12 | 0.15 | 0.17 | 0.19 | 0.22 | 0.24 | 0.29 | 0.34 | 0.39 | 0.44 | 798 | 555 |
| 2 | fastest | 0.24 | 0.32 | 0.40 | 0.48 | 0.56 | 0.63 | 0.71 | 0.79 | 0.95 | 1.11 | 1.27 | 1.43 | 243 | -- |
| 3 | full | 0.08 | 0.11 | 0.14 | 0.17 | 0.19 | 0.22 | 0.25 | 0.28 | 0.33 | 0.39 | 0.44 | 0.50 | 1,050 | 710 |
| 3 | -10 tip | 0.11 | 0.15 | 0.18 | 0.22 | 0.25 | 0.29 | 0.33 | 0.36 | 0.44 | 0.51 | 0.58 | 0.65 | 798 | 458 |
| 3 | fastest | 0.26 | 0.34 | 0.43 | 0.51 | 0.60 | 0.68 | 0.77 | 0.85 | 1.02 | 1.19 | 1.36 | 1.54 | 340 | -- |
| 4 | full | 0.11 | 0.15 | 0.18 | 0.22 | 0.26 | 0.29 | 0.33 | 0.37 | 0.44 | 0.52 | 0.59 | 0.66 | 1,050 | 626 |
| 4 | -10 tip | 0.15 | 0.19 | 0.24 | 0.29 | 0.34 | 0.39 | 0.44 | 0.48 | 0.58 | 0.68 | 0.77 | 0.87 | 798 | 375 |
| 4 | fastest | 0.27 | 0.36 | 0.46 | 0.55 | 0.64 | 0.73 | 0.82 | 0.91 | 1.09 | 1.28 | 1.46 | 1.64 | 423 | -- |
| 5 | full | 0.14 | 0.18 | 0.23 | 0.28 | 0.32 | 0.37 | 0.41 | 0.46 | 0.55 | 0.64 | 0.74 | 0.83 | 1,050 | 553 |
| 5 | -10 tip | 0.18 | 0.24 | 0.30 | 0.36 | 0.42 | 0.48 | 0.54 | 0.61 | 0.73 | 0.85 | 0.97 | 1.09 | 798 | 301 |
| 5 | fastest | 0.29 | 0.39 | 0.49 | 0.58 | 0.68 | 0.78 | 0.87 | 0.97 | 1.17 | 1.36 | 1.55 | 1.75 | 497 | -- |
| 6 | full | 0.17 | 0.22 | 0.28 | 0.33 | 0.39 | 0.44 | 0.50 | 0.55 | 0.66 | 0.77 | 0.88 | 0.99 | 1,050 | 488 |
| 6 | -10 tip | 0.22 | 0.29 | 0.36 | 0.44 | 0.51 | 0.58 | 0.65 | 0.73 | 0.87 | 1.02 | 1.16 | 1.31 | 798 | 236 |
| 6 | fastest | 0.31 | 0.41 | 0.52 | 0.62 | 0.72 | 0.82 | 0.93 | 1.03 | 1.24 | 1.44 | 1.65 | 1.86 | 562 | -- |

APPENDIX A4-A—Table 1b. Isokinetic transit rates for a 1-liter bottle sampler with a 1/4-inch nozzle—Continued

| Depth (in feet) | Rate | Mean stream velocity in vertical (feet per second) | | | | | | | | | | | Max. vol. -10 vol. min. vol. | Volume- min. vol. (mL) | |
|-----------------------|---------|--|------|------|------|------|------|------|------|------|------|------|------------------------------------|------------------------------|-----|
| | | 1.50 | 2.00 | 2.50 | 3.00 | 3.50 | 4.00 | 4.50 | 5.00 | 6.00 | 7.00 | 8.00 | | | |
| 7 | full | 0.19 | 0.26 | 0.32 | 0.39 | 0.45 | 0.52 | 0.58 | 0.64 | 0.77 | 0.90 | 1.03 | 1.16 | 1,050 | 430 |
| 7 | -10 tip | 0.25 | 0.34 | 0.42 | 0.51 | 0.59 | 0.68 | 0.76 | 0.85 | 1.02 | 1.19 | 1.36 | 1.52 | 798 | 178 |
| 7 | fastest | 0.33 | 0.44 | 0.55 | 0.65 | 0.76 | 0.87 | 0.98 | 1.09 | 1.31 | 1.53 | 1.74 | 1.96 | 620 | -- |
| 8 | full | 0.22 | 0.29 | 0.37 | 0.44 | 0.52 | 0.59 | 0.66 | 0.74 | 0.88 | 1.03 | 1.18 | 1.32 | 1,050 | 378 |
| 8 | -10 tip | 0.29 | 0.39 | 0.48 | 0.58 | 0.68 | 0.77 | 0.87 | 0.97 | 1.16 | 1.36 | 1.55 | 1.74 | 798 | 126 |
| 8 | fastest | 0.34 | 0.46 | 0.57 | 0.69 | 0.80 | 0.92 | 1.03 | 1.15 | 1.38 | 1.61 | 1.84 | 2.07 | 672 | -- |
| 10 | full | 0.28 | 0.37 | 0.46 | 0.55 | 0.64 | 0.74 | 0.83 | 0.92 | 1.10 | 1.29 | 1.47 | 1.66 | 1,050 | 288 |
| 10 | -10 tip | 0.36 | 0.48 | 0.61 | 0.73 | 0.85 | 0.97 | 1.09 | 1.21 | 1.45 | 1.69 | 1.94 | 2.18 | 798 | 37 |
| 10 | fastest | 0.38 | 0.51 | 0.63 | 0.76 | 0.89 | 1.01 | 1.14 | 1.27 | 1.52 | 1.78 | 2.03 | 2.28 | 761 | -- |
| 12 | full | 0.33 | 0.44 | 0.55 | 0.66 | 0.77 | 0.88 | 0.99 | 1.10 | 1.32 | 1.55 | 1.77 | 1.99 | 1,050 | 214 |
| 12 | -10 tip | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 12 | fastest | 0.42 | 0.55 | 0.69 | 0.83 | 0.97 | 1.11 | 1.25 | 1.39 | 1.66 | 1.94 | 2.22 | 2.50 | 836 | -- |
| 14 | full | 0.39 | 0.52 | 0.64 | 0.77 | 0.90 | 1.03 | 1.16 | 1.29 | 1.55 | 1.80 | 2.06 | 2.32 | 1,050 | 152 |
| 14 | -10 tip | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 14 | fastest | 0.45 | 0.60 | 0.75 | 0.90 | 1.05 | 1.20 | 1.36 | 1.51 | 1.81 | 2.11 | 2.41 | 2.71 | 898 | -- |
| 15 | full | 0.41 | 0.55 | 0.69 | 0.83 | 0.97 | 1.10 | 1.24 | 1.38 | 1.66 | 1.93 | 2.21 | 2.48 | 1,050 | 124 |
| 15 | -10 tip | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 15 | fastest | 0.47 | 0.63 | 0.78 | 0.94 | 1.10 | 1.25 | 1.41 | 1.57 | 1.88 | 2.19 | 2.50 | 2.82 | 926 | -- |

APPENDIX A4-A—Table 1c. Isokinetic transit rates for a 1-liter bottle sampler with a 5/16-inch nozzle

[Transit rates in feet per second; Depth is water depth - unsampled zone; max, maximum; vol, volume; min, minimum; mL, milliliter; --, not applicable]

| Depth (in feet) | Rate | Mean stream velocity in vertical (feet per second) | | | | | | | | | | | Max. vol. -10 vol. min. vol. | Volume- min. vol. (mL) | |
|-----------------------|---------|--|------|------|------|------|------|------|------|------|------|------|------------------------------------|------------------------------|-----|
| | | 1.50 | 2.00 | 2.50 | 3.00 | 3.50 | 4.00 | 4.50 | 5.00 | 6.00 | 7.00 | 8.00 | | | |
| 1 | full | 0.04 | 0.06 | 0.07 | 0.09 | 0.10 | 0.12 | 0.13 | 0.14 | 0.17 | 0.20 | 0.23 | 0.26 | 1,049 | 918 |
| 1 | -10 tip | 0.06 | 0.08 | 0.09 | 0.11 | 0.13 | 0.15 | 0.17 | 0.19 | 0.23 | 0.26 | 0.30 | 0.34 | 800 | 668 |
| 1 | fastest | 0.34 | 0.46 | 0.57 | 0.69 | 0.80 | 0.92 | 1.03 | 1.15 | 1.38 | 1.61 | 1.84 | 2.07 | 132 | -- |
| 2 | full | 0.09 | 0.12 | 0.14 | 0.17 | 0.20 | 0.23 | 0.26 | 0.29 | 0.35 | 0.40 | 0.46 | 0.52 | 1,049 | 806 |
| 2 | -10 tip | 0.11 | 0.15 | 0.19 | 0.23 | 0.26 | 0.30 | 0.34 | 0.38 | 0.45 | 0.53 | 0.60 | 0.68 | 800 | 557 |
| 2 | fastest | 0.37 | 0.50 | 0.62 | 0.74 | 0.87 | 0.99 | 1.12 | 1.24 | 1.49 | 1.74 | 1.98 | 2.23 | 243 | -- |
| 3 | full | 0.13 | 0.17 | 0.22 | 0.26 | 0.30 | 0.35 | 0.39 | 0.43 | 0.52 | 0.60 | 0.69 | 0.78 | 1,049 | 709 |
| 3 | -10 tip | 0.17 | 0.23 | 0.28 | 0.34 | 0.40 | 0.45 | 0.51 | 0.57 | 0.68 | 0.79 | 0.91 | 1.02 | 800 | 460 |
| 3 | fastest | 0.40 | 0.53 | 0.67 | 0.80 | 0.93 | 1.07 | 1.20 | 1.33 | 1.60 | 1.87 | 2.13 | 2.40 | 340 | -- |
| 4 | full | 0.17 | 0.23 | 0.29 | 0.35 | 0.40 | 0.46 | 0.52 | 0.58 | 0.69 | 0.81 | 0.92 | 1.04 | 1,049 | 626 |
| 4 | -10 tip | 0.23 | 0.30 | 0.38 | 0.45 | 0.53 | 0.60 | 0.68 | 0.75 | 0.91 | 1.06 | 1.21 | 1.36 | 800 | 376 |
| 4 | fastest | 0.43 | 0.57 | 0.71 | 0.86 | 1.00 | 1.14 | 1.28 | 1.43 | 1.71 | 2.00 | 2.28 | 2.57 | 424 | -- |
| 5 | full | 0.22 | 0.29 | 0.36 | 0.43 | 0.50 | 0.58 | 0.65 | 0.72 | 0.86 | 1.01 | 1.15 | 1.29 | 1,049 | 552 |
| 5 | -10 tip | 0.28 | 0.38 | 0.47 | 0.57 | 0.66 | 0.75 | 0.85 | 0.94 | 1.13 | 1.32 | 1.51 | 1.70 | 800 | 303 |
| 5 | fastest | 0.46 | 0.61 | 0.76 | 0.91 | 1.06 | 1.21 | 1.37 | 1.52 | 1.82 | 2.13 | 2.43 | 2.73 | 497 | -- |
| 6 | full | 0.26 | 0.35 | 0.43 | 0.52 | 0.60 | 0.69 | 0.78 | 0.86 | 1.04 | 1.21 | 1.38 | 1.55 | 1,049 | 487 |
| 6 | -10 tip | 0.34 | 0.45 | 0.57 | 0.68 | 0.79 | 0.91 | 1.02 | 1.13 | 1.36 | 1.58 | 1.81 | 2.04 | 800 | 238 |
| 6 | fastest | 0.48 | 0.64 | 0.81 | 0.97 | 1.13 | 1.29 | 1.45 | 1.61 | 1.93 | 2.26 | 2.58 | 2.90 | 562 | -- |

APPENDIX A4-A—Table 1c. Isokinetic transit rates for a 1-liter bottle sampler with a 5/16-inch nozzle—Continued

| Depth (in feet) | Rate | Mean stream velocity in vertical (feet per second) | | | | | | | | | | | Max. vol. -10 vol. min. vol. | Volume- min. vol. (mL) | |
|-----------------------|---------|--|------|------|------|------|------|------|------|------|------|------|------------------------------------|------------------------------|-----|
| | | 1.50 | 2.00 | 2.50 | 3.00 | 3.50 | 4.00 | 4.50 | 5.00 | 6.00 | 7.00 | 8.00 | | | |
| 7 | full | 0.30 | 0.40 | 0.50 | 0.60 | 0.71 | 0.81 | 0.91 | 1.01 | 1.21 | 1.41 | 1.61 | 1.81 | 1,049 | 429 |
| 7 | -10 tip | 0.40 | 0.53 | 0.66 | 0.79 | 0.92 | 1.06 | 1.19 | 1.32 | 1.58 | 1.85 | 2.11 | 2.38 | 800 | 180 |
| 7 | fastest | 0.51 | 0.68 | 0.85 | 1.02 | 1.19 | 1.36 | 1.53 | 1.70 | 2.04 | 2.38 | 2.73 | 3.07 | 620 | -- |
| 8 | full | 0.35 | 0.46 | 0.58 | 0.69 | 0.81 | 0.92 | 1.04 | 1.15 | 1.38 | 1.61 | 1.84 | 2.07 | 1,049 | 377 |
| 8 | -10 tip | 0.45 | 0.60 | 0.75 | 0.91 | 1.06 | 1.21 | 1.36 | 1.51 | 1.81 | 2.11 | 2.42 | 2.72 | 800 | 128 |
| 8 | fastest | 0.54 | 0.72 | 0.90 | 1.08 | 1.26 | 1.44 | 1.62 | 1.80 | 2.16 | 2.51 | 2.87 | 3.23 | 672 | -- |
| 10 | full | 0.43 | 0.58 | 0.72 | 0.86 | 1.01 | 1.15 | 1.29 | 1.44 | 1.73 | 2.01 | 2.30 | 2.59 | 1,049 | 287 |
| 10 | -10 tip | 0.57 | 0.75 | 0.94 | 1.13 | 1.32 | 1.51 | 1.70 | 1.89 | 2.26 | 2.64 | 3.02 | 3.40 | 800 | 38 |
| 10 | fastest | 0.59 | 0.79 | 0.99 | 1.19 | 1.39 | 1.59 | 1.78 | 1.98 | 2.38 | 2.77 | 3.17 | 3.57 | 762 | -- |
| 11 | full | 0.47 | 0.63 | 0.79 | 0.95 | 1.11 | 1.27 | 1.42 | 1.58 | 1.90 | 2.22 | 2.53 | 2.85 | 1,049 | 219 |
| 11 | -10 tip | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 11 | fastest | 0.60 | 0.80 | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 830 | -- |
| 12 | full | 0.52 | 0.69 | 0.86 | 1.04 | 1.21 | 1.38 | 1.55 | 1.73 | 2.07 | 2.42 | 2.76 | 3.11 | 1,049 | 143 |
| 12 | -10 tip | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 12 | fastest | 0.60 | 0.80 | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 906 | -- |
| 13 | full | 0.56 | 0.75 | 0.94 | 1.12 | 1.31 | 1.50 | 1.68 | 1.87 | 2.24 | 2.62 | 2.99 | 3.37 | 1,049 | 68 |
| 13 | -10 tip | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 13 | fastest | 0.60 | 0.80 | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 981 | -- |

APPENDIX A4-A—Table 2a. Isokinetic transit rates for a 3-liter bottle sampler with a 1/4-inch nozzle

[Transit rates in feet per second; Depth is water depth - unsampled zone; max, maximum; vol, volume; min, minimum; mL, milliliter; --, not applicable]

| Depth (in feet) | Rate | Mean stream velocity in vertical (feet per second) | | | | | | | | | | | Max. vol. -10 vol. min. vol. | Volume- min. vol. (mL) | |
|-----------------------|---------|--|------|------|------|------|------|------|------|------|------|------|------------------------------------|------------------------------|-------|
| | | 1.50 | 2.00 | 2.50 | 3.00 | 3.50 | 4.00 | 4.50 | 5.00 | 6.00 | 7.00 | 8.00 | | | |
| 2 | full | 0.02 | 0.03 | 0.03 | 0.04 | 0.05 | 0.05 | 0.06 | 0.07 | 0.08 | 0.10 | 0.11 | 0.12 | 2,832 | 2,120 |
| 2 | -10 tip | 0.02 | 0.03 | 0.04 | 0.05 | 0.06 | 0.06 | 0.07 | 0.08 | 0.09 | 0.11 | 0.13 | 0.14 | 2,457 | 1,745 |
| 2 | fastest | 0.08 | 0.11 | 0.14 | 0.16 | 0.19 | 0.22 | 0.24 | 0.27 | 0.33 | 0.38 | 0.43 | 0.49 | 712 | -- |
| 3 | full | 0.03 | 0.04 | 0.05 | 0.06 | 0.07 | 0.08 | 0.09 | 0.10 | 0.12 | 0.14 | 0.16 | 0.18 | 2,832 | 1,840 |
| 3 | -10 tip | 0.04 | 0.05 | 0.06 | 0.07 | 0.08 | 0.09 | 0.11 | 0.12 | 0.14 | 0.17 | 0.19 | 0.21 | 2,457 | 1,465 |
| 3 | fastest | 0.09 | 0.12 | 0.15 | 0.18 | 0.20 | 0.23 | 0.26 | 0.29 | 0.35 | 0.41 | 0.47 | 0.53 | 992 | -- |
| 4 | full | 0.04 | 0.05 | 0.07 | 0.08 | 0.10 | 0.11 | 0.12 | 0.14 | 0.16 | 0.19 | 0.22 | 0.25 | 2,832 | 1,597 |
| 4 | -10 tip | 0.05 | 0.06 | 0.08 | 0.09 | 0.11 | 0.13 | 0.14 | 0.16 | 0.19 | 0.22 | 0.25 | 0.28 | 2,457 | 1,222 |
| 4 | fastest | 0.09 | 0.13 | 0.16 | 0.19 | 0.22 | 0.25 | 0.28 | 0.31 | 0.38 | 0.44 | 0.50 | 0.56 | 1,235 | -- |
| 5 | full | 0.05 | 0.07 | 0.09 | 0.10 | 0.12 | 0.14 | 0.15 | 0.17 | 0.20 | 0.24 | 0.27 | 0.31 | 2,832 | 1,383 |
| 5 | -10 tip | 0.06 | 0.08 | 0.10 | 0.12 | 0.14 | 0.16 | 0.18 | 0.20 | 0.24 | 0.28 | 0.31 | 0.35 | 2,457 | 1,009 |
| 5 | fastest | 0.10 | 0.13 | 0.17 | 0.20 | 0.23 | 0.27 | 0.30 | 0.33 | 0.40 | 0.47 | 0.53 | 0.60 | 1,449 | -- |
| 6 | full | 0.06 | 0.08 | 0.10 | 0.12 | 0.14 | 0.16 | 0.18 | 0.20 | 0.25 | 0.29 | 0.33 | 0.37 | 2,832 | 1,195 |
| 6 | -10 tip | 0.07 | 0.09 | 0.12 | 0.14 | 0.17 | 0.19 | 0.21 | 0.24 | 0.28 | 0.33 | 0.38 | 0.42 | 2,457 | 820 |
| 6 | fastest | 0.11 | 0.14 | 0.18 | 0.21 | 0.25 | 0.28 | 0.32 | 0.35 | 0.42 | 0.50 | 0.57 | 0.64 | 1,637 | -- |
| 7 | full | 0.07 | 0.10 | 0.12 | 0.14 | 0.17 | 0.19 | 0.21 | 0.24 | 0.29 | 0.33 | 0.38 | 0.43 | 2,832 | 1,028 |
| 7 | -10 tip | 0.08 | 0.11 | 0.14 | 0.17 | 0.19 | 0.22 | 0.25 | 0.28 | 0.33 | 0.39 | 0.44 | 0.50 | 2,457 | 653 |
| 7 | fastest | 0.11 | 0.15 | 0.19 | 0.22 | 0.26 | 0.30 | 0.34 | 0.37 | 0.45 | 0.52 | 0.60 | 0.67 | 1,804 | -- |

APPENDIX A4-A—Table 2a. Isokinetic transit rates for a 3-liter bottle sampler with a 1/4-inch nozzle—Continued

| Depth (in feet) | Rate | Mean stream velocity in vertical (feet per second) | | | | | | | | | | | Max. vol. -10 vol. min. vol. | Volume- min. vol. (mL) | |
|-----------------------|---------|--|------|------|------|------|------|------|------|------|------|------|------------------------------------|------------------------------|-----|
| | | 1.50 | 2.00 | 2.50 | 3.00 | 3.50 | 4.00 | 4.50 | 5.00 | 6.00 | 7.00 | 8.00 | | | |
| 8 | full | 0.08 | 0.11 | 0.14 | 0.16 | 0.19 | 0.22 | 0.25 | 0.27 | 0.33 | 0.38 | 0.44 | 0.49 | 2,832 | 878 |
| 8 | -10 tip | 0.09 | 0.13 | 0.16 | 0.19 | 0.22 | 0.25 | 0.28 | 0.31 | 0.38 | 0.44 | 0.50 | 0.57 | 2,457 | 503 |
| 8 | fastest | 0.12 | 0.16 | 0.20 | 0.24 | 0.28 | 0.32 | 0.36 | 0.40 | 0.47 | 0.55 | 0.63 | 0.71 | 1,954 | -- |
| 9 | full | 0.09 | 0.12 | 0.15 | 0.18 | 0.21 | 0.25 | 0.28 | 0.31 | 0.37 | 0.43 | 0.49 | 0.55 | 2,832 | 743 |
| 9 | -10 tip | 0.11 | 0.14 | 0.18 | 0.21 | 0.25 | 0.28 | 0.32 | 0.35 | 0.42 | 0.50 | 0.57 | 0.64 | 2,457 | 368 |
| 9 | fastest | 0.12 | 0.17 | 0.21 | 0.25 | 0.29 | 0.33 | 0.37 | 0.42 | 0.50 | 0.58 | 0.67 | 0.75 | 2,089 | -- |
| 10 | full | 0.10 | 0.14 | 0.17 | 0.20 | 0.24 | 0.27 | 0.31 | 0.34 | 0.41 | 0.48 | 0.55 | 0.61 | 2,832 | 620 |
| 10 | -10 tip | 0.12 | 0.16 | 0.20 | 0.24 | 0.28 | 0.31 | 0.35 | 0.39 | 0.47 | 0.55 | 0.63 | 0.71 | 2,457 | 246 |
| 10 | fastest | 0.13 | 0.17 | 0.22 | 0.26 | 0.31 | 0.35 | 0.39 | 0.44 | 0.52 | 0.61 | 0.70 | 0.79 | 2,212 | -- |
| 12 | full | 0.12 | 0.16 | 0.20 | 0.25 | 0.29 | 0.33 | 0.37 | 0.41 | 0.49 | 0.57 | 0.65 | 0.74 | 2,832 | 408 |
| 12 | -10 tip | 0.14 | 0.19 | 0.24 | 0.28 | 0.33 | 0.38 | 0.42 | 0.47 | 0.57 | 0.66 | 0.75 | 0.85 | 2,457 | 33 |
| 12 | fastest | 0.14 | 0.19 | 0.24 | 0.29 | 0.33 | 0.38 | 0.43 | 0.48 | 0.57 | 0.67 | 0.76 | 0.86 | 2,424 | -- |
| 14 | full | 0.14 | 0.19 | 0.24 | 0.29 | 0.33 | 0.38 | 0.43 | 0.48 | 0.57 | 0.67 | 0.76 | 0.86 | 2,832 | 229 |
| 14 | -10 tip | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 14 | fastest | 0.16 | 0.21 | 0.26 | 0.31 | 0.36 | 0.42 | 0.47 | 0.52 | 0.62 | 0.73 | 0.83 | 0.93 | 2,603 | -- |
| 15 | full | 0.15 | 0.20 | 0.26 | 0.31 | 0.36 | 0.41 | 0.46 | 0.51 | 0.61 | 0.72 | 0.82 | 0.92 | 2,832 | 149 |
| 15 | -10 tip | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 15 | fastest | 0.16 | 0.22 | 0.27 | 0.32 | 0.38 | 0.43 | 0.49 | 0.54 | 0.65 | 0.76 | 0.86 | 0.97 | 2,683 | -- |

APPENDIX A4-A—Table 2b. Isokinetic transit rates for a 3-liter bottle sampler with a 5/16-inch nozzle

[Transit rates in feet per second; Depth is water depth - unsampled zone; max, maximum; vol, volume; min, minimum; mL, milliliter; not applicable]

| Depth (in feet) | Rate | Mean stream velocity in vertical (feet per second) | | | | | | | | | | | Max. vol. -10 vol. min. vol. | Volume- min. vol. (mL) | |
|-----------------------|---------|--|------|------|------|------|------|------|------|------|------|------|------------------------------------|------------------------------|-------|
| | | 1.50 | 2.00 | 2.50 | 3.00 | 3.50 | 4.00 | 4.50 | 5.00 | 6.00 | 7.00 | 8.00 | | | |
| 2 | full | 0.03 | 0.04 | 0.05 | 0.06 | 0.07 | 0.09 | 0.10 | 0.11 | 0.13 | 0.15 | 0.17 | 0.19 | 2,830 | 2,118 |
| 2 | -10 tip | 0.04 | 0.05 | 0.06 | 0.07 | 0.09 | 0.10 | 0.11 | 0.12 | 0.15 | 0.17 | 0.20 | 0.22 | 2,461 | 1,749 |
| 2 | fastest | 0.13 | 0.17 | 0.21 | 0.25 | 0.30 | 0.34 | 0.38 | 0.42 | 0.51 | 0.59 | 0.68 | 0.76 | 712 | -- |
| 3 | full | 0.05 | 0.06 | 0.08 | 0.10 | 0.11 | 0.13 | 0.14 | 0.16 | 0.19 | 0.22 | 0.26 | 0.29 | 2,830 | 1,837 |
| 3 | -10 tip | 0.06 | 0.07 | 0.09 | 0.11 | 0.13 | 0.15 | 0.17 | 0.18 | 0.22 | 0.26 | 0.29 | 0.33 | 2,461 | 1,468 |
| 3 | fastest | 0.14 | 0.18 | 0.23 | 0.27 | 0.32 | 0.36 | 0.41 | 0.46 | 0.55 | 0.64 | 0.73 | 0.82 | 993 | -- |
| 4 | full | 0.06 | 0.09 | 0.11 | 0.13 | 0.15 | 0.17 | 0.19 | 0.21 | 0.26 | 0.30 | 0.34 | 0.38 | 2,830 | 1,593 |
| 4 | -10 tip | 0.07 | 0.10 | 0.12 | 0.15 | 0.17 | 0.20 | 0.22 | 0.25 | 0.29 | 0.34 | 0.39 | 0.44 | 2,461 | 1,224 |
| 4 | fastest | 0.15 | 0.20 | 0.24 | 0.29 | 0.34 | 0.39 | 0.44 | 0.49 | 0.59 | 0.68 | 0.78 | 0.88 | 1,237 | -- |
| 5 | full | 0.08 | 0.11 | 0.13 | 0.16 | 0.19 | 0.21 | 0.24 | 0.27 | 0.32 | 0.37 | 0.43 | 0.48 | 2,830 | 1,379 |
| 5 | -10 tip | 0.09 | 0.12 | 0.15 | 0.18 | 0.21 | 0.25 | 0.28 | 0.31 | 0.37 | 0.43 | 0.49 | 0.55 | 2,461 | 1,010 |
| 5 | fastest | 0.16 | 0.21 | 0.26 | 0.31 | 0.36 | 0.42 | 0.47 | 0.52 | 0.62 | 0.73 | 0.83 | 0.94 | 1,451 | -- |
| 6 | full | 0.10 | 0.13 | 0.16 | 0.19 | 0.22 | 0.26 | 0.29 | 0.32 | 0.38 | 0.45 | 0.51 | 0.58 | 2,830 | 1,190 |
| 6 | -10 tip | 0.11 | 0.15 | 0.18 | 0.22 | 0.26 | 0.29 | 0.33 | 0.37 | 0.44 | 0.52 | 0.59 | 0.66 | 2,461 | 820 |
| 6 | fastest | 0.17 | 0.22 | 0.28 | 0.33 | 0.39 | 0.44 | 0.50 | 0.55 | 0.66 | 0.77 | 0.88 | 0.99 | 1,641 | -- |
| 7 | full | 0.11 | 0.15 | 0.19 | 0.22 | 0.26 | 0.30 | 0.34 | 0.37 | 0.45 | 0.52 | 0.60 | 0.67 | 2,830 | 1,021 |
| 7 | -10 tip | 0.13 | 0.17 | 0.21 | 0.26 | 0.30 | 0.34 | 0.39 | 0.43 | 0.52 | 0.60 | 0.69 | 0.77 | 2,461 | 652 |
| 7 | fastest | 0.18 | 0.23 | 0.29 | 0.35 | 0.41 | 0.47 | 0.53 | 0.58 | 0.70 | 0.82 | 0.93 | 1.05 | 1,809 | -- |

APPENDIX A4-A—Table 2b. Isokinetic transit rates for a 3-liter bottle sampler with a 5/16-inch nozzle—Continued

| Depth (in feet) | Rate | Mean stream velocity in vertical (feet per second) | | | | | | | | | | | Max. vol. -10 vol. min. vol. | Volume- min. vol. (mL) | |
|-----------------------|---------|--|------|------|------|------|------|------|------|------|------|------|------------------------------------|------------------------------|-----|
| | | 1.50 | 2.00 | 2.50 | 3.00 | 3.50 | 4.00 | 4.50 | 5.00 | 6.00 | 7.00 | 8.00 | | | |
| 8 | full | 0.13 | 0.17 | 0.21 | 0.26 | 0.30 | 0.34 | 0.38 | 0.43 | 0.51 | 0.60 | 0.68 | 0.77 | 2,830 | 870 |
| 8 | -10 tip | 0.15 | 0.20 | 0.25 | 0.29 | 0.34 | 0.39 | 0.44 | 0.49 | 0.59 | 0.69 | 0.79 | 0.88 | 2,461 | 501 |
| 8 | fastest | 0.18 | 0.25 | 0.31 | 0.37 | 0.43 | 0.49 | 0.55 | 0.62 | 0.74 | 0.86 | 0.99 | 1.11 | 1,960 | -- |
| 9 | full | 0.14 | 0.19 | 0.24 | 0.29 | 0.34 | 0.38 | 0.43 | 0.48 | 0.58 | 0.67 | 0.77 | 0.86 | 2,830 | 734 |
| 9 | -10 tip | 0.17 | 0.22 | 0.28 | 0.33 | 0.39 | 0.44 | 0.50 | 0.55 | 0.66 | 0.77 | 0.88 | 0.99 | 2,461 | 365 |
| 9 | fastest | 0.19 | 0.26 | 0.32 | 0.39 | 0.45 | 0.52 | 0.58 | 0.65 | 0.78 | 0.91 | 1.04 | 1.17 | 2,096 | -- |
| 10 | full | 0.16 | 0.21 | 0.27 | 0.32 | 0.37 | 0.43 | 0.48 | 0.53 | 0.64 | 0.75 | 0.85 | 0.96 | 2,830 | 610 |
| 10 | -10 tip | 0.18 | 0.25 | 0.31 | 0.37 | 0.43 | 0.49 | 0.55 | 0.61 | 0.74 | 0.86 | 0.98 | 1.10 | 2,461 | 241 |
| 10 | fastest | 0.20 | 0.27 | 0.34 | 0.41 | 0.48 | 0.54 | 0.61 | 0.68 | 0.82 | 0.95 | 1.09 | 1.22 | 2,220 | -- |
| 12 | full | 0.19 | 0.26 | 0.32 | 0.38 | 0.45 | 0.51 | 0.58 | 0.64 | 0.77 | 0.90 | 1.02 | 1.15 | 2,830 | 396 |
| 12 | -10 tip | 0.22 | 0.29 | 0.37 | 0.44 | 0.52 | 0.59 | 0.66 | 0.74 | 0.88 | 1.03 | 1.18 | 1.32 | 2,461 | 26 |
| 12 | fastest | 0.22 | 0.30 | 0.37 | 0.45 | 0.52 | 0.60 | 0.67 | 0.74 | 0.89 | 1.04 | 1.19 | 1.34 | 2,435 | -- |
| 14 | full | 0.22 | 0.30 | 0.37 | 0.45 | 0.52 | 0.60 | 0.67 | 0.75 | 0.90 | 1.05 | 1.19 | 1.34 | 2,830 | 215 |
| 14 | -10 tip | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 14 | fastest | 0.24 | 0.32 | 0.40 | 0.48 | 0.57 | 0.65 | 0.73 | 0.81 | 0.97 | 1.13 | 1.29 | 1.45 | 2,615 | -- |
| 15 | full | 0.24 | 0.32 | 0.40 | 0.48 | 0.56 | 0.64 | 0.72 | 0.80 | 0.96 | 1.12 | 1.28 | 1.44 | 2,830 | 135 |
| 15 | -10 tip | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 15 | fastest | 0.25 | 0.34 | 0.42 | 0.50 | 0.59 | 0.67 | 0.76 | 0.84 | 1.01 | 1.18 | 1.34 | 1.51 | 2,695 | -- |

APPENDIX A4-A—Table 3a. Minimum volumes for isokinetic sampling with a bag sampler

[The volumes listed below are the minimum volumes that must be collected in a bag sampler to have not exceeded 0.4 times the mean stream velocity. Generally, bag samplers must be operated in water warmer than 7 degrees Celsius and where the velocity is greater than 3 feet per second.]

| Water depth minus unsampled zone, in feet | Minimum volume (in milliliters) for the nozzle diameter (inch) shown ¹ | | |
|---|---|----------|-----------|
| | 3/16 inch | 1/4 inch | 5/16 inch |
| 1 | 27 | 48 | 75 |
| 2 | 54 | 96 | 151 |
| 3 | 81 | 145 | 226 |
| 4 | 109 | 193 | 301 |
| 5 | 136 | 241 | 377 |
| 6 | 163 | 289 | 452 |
| 7 | 190 | 338 | 528 |
| 8 | 217 | 386 | 603 |
| 9 | 244 | 434 | 678 |
| 10 | 271 | 483 | 754 |
| 11 | 298 | 531 | 829 |
| 12 | 326 | 579 | 904 |
| 13 | 353 | 627 | 980 |
| 14 | 380 | 675 | 1,055 |
| 15 | 407 | 724 | 1,131 |
| 20 | 543 | 965 | 1,507 |
| 25 | 678 | 1,206 | 1,884 |
| 30 | 814 | 1,447 | 2,262 |
| 35 | 950 | 1,688 | 2,638 |
| 40 | 1,085 | 1,930 | 3,015 |
| 45 | 1,221 | 2,171 | 3,392 |
| 50 | 1,357 | 2,412 | 3,769 |
| 55 | 1,492 | 2,653 | 4,146 |
| 60 | 1,629 | 2,894 | 4,524 |
| 65 | 1,764 | 3,136 | 4,899 |
| 70 | 1,899 | 3,377 | 5,276 |
| 75 | 2,035 | 3,618 | 5,653 |

APPENDIX A4-A—Table 3a. Minimum volumes for isokinetic sampling with a bag sampler—*Continued*

| Water depth minus unsampled zone, in feet | Minimum volume (in milliliters) for the nozzle diameter (inch) shown ¹ | | |
|---|---|----------|-----------|
| | 3/16 inch | 1/4 inch | 5/16 inch |
| 80 | 2,171 | 3,859 | 6,030 |
| 85 | 2,306 | 4,100 | 6,407 |
| 90 | 2,442 | 4,342 | 6,784 |
| 95 | 2,578 | 4,583 | 7,161 |
| 100 | 2,713 | 4,824 | 7,537 |
| 120 | 3,257 | 5,789 | 9,045 |
| 140 | 3,799 | 6,754 | 10,552 |
| 160 | 4,342 | 7,718 | 12,060 |
| 180 | 4,884 | 8,683 | 13,567 |
| 200 | 5,427 | 9,650 | 15,075 |

¹Minimum volume = area of nozzle x time in water x mean stream velocity in vertical; minimum volume in milliliters = $15 \times 3.14 \times 2.54 \text{ cubed} \times \text{nozzle diameter, in inches squared} \times \text{depth, in feet}$.

APPENDIX A4-A—Table 3b. Isokinetic transit rates for a 3-liter bag sampler with a 1/4-inch nozzle

[Transit rates in feet per second; Depth is water depth - unsampled zone; max, maximum; vol, volume; min, minimum; mL, milliliter; --, not applicable]

| Depth (in feet) | Rate | Mean stream velocity in vertical (feet per second) | | | | | | | | | | | | Max. vol. -10 vol. min. vol. | Volume- min. vol. (mL) |
|-----------------------|---------|--|------|------|------|------|------|------|------|------|------|-------|-------|------------------------------------|------------------------------|
| | | 2.50 | 3.00 | 3.50 | 4.00 | 4.50 | 5.00 | 6.00 | 7.00 | 8.00 | 9.00 | 10.00 | 12.00 | | |
| 6 | full | 0.11 | 0.13 | 0.16 | 0.18 | 0.20 | 0.22 | 0.27 | 0.31 | 0.36 | 0.40 | 0.44 | 0.53 | 2,607 | 2,318 |
| 6 | fastest | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 | 4.80 | 290 | -- |
| 8 | full | 0.15 | 0.18 | 0.21 | 0.24 | 0.27 | 0.30 | 0.36 | 0.41 | 0.47 | 0.53 | 0.59 | 0.71 | 2,607 | 2,221 |
| 8 | fastest | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 | 4.80 | 386 | -- |
| 10 | full | 0.19 | 0.22 | 0.26 | 0.30 | 0.33 | 0.37 | 0.44 | 0.52 | 0.59 | 0.67 | 0.74 | 0.89 | 2,607 | 2,125 |
| 10 | fastest | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 | 4.80 | 483 | -- |
| 12 | full | 0.22 | 0.27 | 0.31 | 0.36 | 0.40 | 0.44 | 0.53 | 0.62 | 0.71 | 0.80 | 0.89 | 1.07 | 2,607 | 2,028 |
| 12 | fastest | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 | 4.80 | 579 | -- |
| 14 | full | 0.26 | 0.31 | 0.36 | 0.41 | 0.47 | 0.52 | 0.62 | 0.73 | 0.83 | 0.93 | 1.04 | 1.24 | 2,607 | 1,931 |
| 14 | fastest | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 | 4.80 | 676 | -- |
| 16 | full | 0.30 | 0.36 | 0.41 | 0.47 | 0.53 | 0.59 | 0.71 | 0.83 | 0.95 | 1.07 | 1.19 | 1.42 | 2,607 | 1,835 |
| 16 | fastest | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 | 4.80 | 773 | -- |
| 18 | full | 0.33 | 0.40 | 0.47 | 0.53 | 0.60 | 0.67 | 0.80 | 0.93 | 1.07 | 1.20 | 1.33 | 1.60 | 2,607 | 1,738 |
| 18 | fastest | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 | 4.80 | 869 | -- |
| 20 | full | 0.37 | 0.44 | 0.52 | 0.59 | 0.67 | 0.74 | 0.89 | 1.04 | 1.19 | 1.33 | 1.48 | 1.78 | 2,607 | 1,642 |
| 20 | fastest | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 | 4.80 | 966 | -- |
| 22 | full | 0.41 | 0.49 | 0.57 | 0.65 | 0.73 | 0.81 | 0.98 | 1.14 | 1.30 | 1.47 | 1.63 | 1.96 | 2,607 | 1,545 |
| 22 | fastest | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 | 4.80 | 1,062 | -- |

APPENDIX A4-A—Table 3b. Isokinetic transit rates for a 3-liter bag sampler with a 1/4-inch nozzle—Continued

| Depth (in feet) | Rate | Mean stream velocity in vertical (feet per second) | | | | | | | | | | | | Max. vol. -10 vol. min. vol. | Volume- min. vol. (mL) |
|-----------------------|---------|--|------|------|------|------|------|------|------|------|------|-------|-------|------------------------------------|------------------------------|
| | | 2.50 | 3.00 | 3.50 | 4.00 | 4.50 | 5.00 | 6.00 | 7.00 | 8.00 | 9.00 | 10.00 | 12.00 | | |
| 24 | full | 0.44 | 0.53 | 0.62 | 0.71 | 0.80 | 0.89 | 1.07 | 1.24 | 1.42 | 1.60 | 1.78 | 2.13 | 2,607 | 1,449 |
| 24 | fastest | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 | 4.80 | 1,159 | -- |
| 26 | full | 0.48 | 0.58 | 0.67 | 0.77 | 0.87 | 0.96 | 1.16 | 1.35 | 1.54 | 1.73 | 1.93 | 2.31 | 2,607 | 1,352 |
| 26 | fastest | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 | 4.80 | 1,255 | -- |
| 28 | full | 0.52 | 0.62 | 0.73 | 0.83 | 0.93 | 1.04 | 1.24 | 1.45 | 1.66 | 1.87 | 2.07 | 2.49 | 2,607 | 1,255 |
| 28 | fastest | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 | 4.80 | 1,352 | -- |
| 30 | full | 0.56 | 0.67 | 0.78 | 0.89 | 1.00 | 1.11 | 1.33 | 1.56 | 1.78 | 2.00 | 2.22 | 2.67 | 2,607 | 1,159 |
| 30 | fastest | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 | 4.80 | 1,449 | -- |
| 35 | full | 0.65 | 0.78 | 0.91 | 1.04 | 1.17 | 1.30 | 1.56 | 1.81 | 2.07 | 2.33 | 2.59 | 3.11 | 2,607 | 917 |
| 35 | fastest | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 | 4.80 | 1,690 | -- |
| 40 | full | 0.74 | 0.89 | 1.04 | 1.19 | 1.33 | 1.48 | 1.78 | 2.07 | 2.37 | 2.67 | 2.96 | 3.56 | 2,607 | 676 |
| 40 | fastest | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 | 4.80 | 1,931 | -- |
| 45 | full | 0.83 | 1.00 | 1.17 | 1.33 | 1.50 | 1.67 | 2.00 | 2.33 | 2.67 | 3.00 | 3.33 | 4.00 | 2,607 | 435 |
| 45 | fastest | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 | 4.80 | 2,173 | -- |
| 50 | full | 0.93 | 1.11 | 1.30 | 1.48 | 1.67 | 1.85 | 2.22 | 2.59 | 2.96 | 3.33 | 3.70 | 4.44 | 2,607 | 193 |
| 50 | fastest | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 | 4.80 | 2,414 | -- |
| 53 | full | 0.98 | 1.18 | 1.37 | 1.57 | 1.77 | 1.96 | 2.36 | 2.75 | 3.14 | 3.53 | 3.93 | 4.71 | 2,607 | 48 |
| 53 | fastest | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 | 4.80 | 2,559 | -- |

APPENDIX A4-A—Table 3c. Isokinetic transit rates for a 3-liter bag sampler with a 5/16-inch nozzle

[Transit rates in feet per second; Depth is water depth - unsampled zone; max, maximum; vol, volume; min, minimum; mL, milliliter; --, not applicable]

| Depth (in feet) | Rate | Mean stream velocity in vertical (feet per second) | | | | | | | | | | | | Max. vol. -10 vol. min. vol. | Volume- min. vol. (mL) |
|-----------------------|---------|--|------|------|------|------|------|------|------|------|------|-------|-------|------------------------------------|------------------------------|
| | | 2.50 | 3.00 | 3.50 | 4.00 | 4.50 | 5.00 | 6.00 | 7.00 | 8.00 | 9.00 | 10.00 | 12.00 | | |
| 2 | full | 0.06 | 0.07 | 0.08 | 0.09 | 0.10 | 0.12 | 0.14 | 0.16 | 0.19 | 0.21 | 0.23 | 0.28 | 2,604 | 2,453 |
| 2 | fastest | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 | 4.80 | 151 | -- |
| 4 | full | 0.12 | 0.14 | 0.16 | 0.19 | 0.21 | 0.23 | 0.28 | 0.32 | 0.37 | 0.42 | 0.46 | 0.56 | 2,604 | 2,302 |
| 4 | fastest | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 | 4.80 | 302 | -- |
| 6 | full | 0.17 | 0.21 | 0.24 | 0.28 | 0.31 | 0.35 | 0.42 | 0.49 | 0.56 | 0.63 | 0.70 | 0.83 | 2,604 | 2,151 |
| 6 | fastest | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 | 4.80 | 453 | -- |
| 8 | full | 0.23 | 0.28 | 0.32 | 0.37 | 0.42 | 0.46 | 0.56 | 0.65 | 0.74 | 0.83 | 0.93 | 1.11 | 2,604 | 2,000 |
| 8 | fastest | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 | 4.80 | 604 | -- |
| 10 | full | 0.29 | 0.35 | 0.41 | 0.46 | 0.52 | 0.58 | 0.70 | 0.81 | 0.93 | 1.04 | 1.16 | 1.39 | 2,604 | 1,849 |
| 10 | fastest | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 | 4.80 | 755 | -- |
| 12 | full | 0.35 | 0.42 | 0.49 | 0.56 | 0.63 | 0.70 | 0.83 | 0.97 | 1.11 | 1.25 | 1.39 | 1.67 | 2,604 | 1,698 |
| 12 | fastest | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 | 4.80 | 906 | -- |
| 14 | full | 0.41 | 0.49 | 0.57 | 0.65 | 0.73 | 0.81 | 0.97 | 1.14 | 1.30 | 1.46 | 1.62 | 1.95 | 2,604 | 1,547 |
| 14 | fastest | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 | 4.80 | 1,057 | -- |
| 16 | full | 0.46 | 0.56 | 0.65 | 0.74 | 0.83 | 0.93 | 1.11 | 1.30 | 1.48 | 1.67 | 1.86 | 2.23 | 2,604 | 1,396 |
| 16 | fastest | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 | 4.80 | 1,208 | -- |
| 18 | full | 0.52 | 0.63 | 0.73 | 0.83 | 0.94 | 1.04 | 1.25 | 1.46 | 1.67 | 1.88 | 2.09 | 2.50 | 2,604 | 1,245 |
| 18 | fastest | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 | 4.80 | 1,359 | -- |

APPENDIX A4-A—Table 3c. Isokinetic transit rates for a 3-liter bag sampler with a 5/16-inch nozzle—Continued

| Depth (in feet) | Rate | Mean stream velocity in vertical (feet per second) | | | | | | | | | | | | Max. vol. -10 vol. min. vol. | Volume- min. vol. (mL) |
|-----------------------|---------|--|------|------|------|------|------|------|------|------|------|-------|-------|------------------------------------|------------------------------|
| | | 2.50 | 3.00 | 3.50 | 4.00 | 4.50 | 5.00 | 6.00 | 7.00 | 8.00 | 9.00 | 10.00 | 12.00 | | |
| 20 | full | 0.58 | 0.70 | 0.81 | 0.93 | 1.04 | 1.16 | 1.39 | 1.62 | 1.86 | 2.09 | 2.32 | 2.78 | 2,604 | 1,094 |
| 20 | fastest | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 | 4.80 | 1,509 | -- |
| 22 | full | 0.64 | 0.77 | 0.89 | 1.02 | 1.15 | 1.28 | 1.53 | 1.79 | 2.04 | 2.30 | 2.55 | 3.06 | 2,604 | 943 |
| 22 | fastest | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 | 4.80 | 1,660 | -- |
| 24 | full | 0.70 | 0.83 | 0.97 | 1.11 | 1.25 | 1.39 | 1.67 | 1.95 | 2.23 | 2.50 | 2.78 | 3.34 | 2,604 | 792 |
| 24 | fastest | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 | 4.80 | 1,811 | -- |
| 26 | full | 0.75 | 0.90 | 1.06 | 1.21 | 1.36 | 1.51 | 1.81 | 2.11 | 2.41 | 2.71 | 3.01 | 3.62 | 2,604 | 642 |
| 26 | fastest | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 | 4.80 | 1,962 | -- |
| 28 | full | 0.81 | 0.97 | 1.14 | 1.30 | 1.46 | 1.62 | 1.95 | 2.27 | 2.60 | 2.92 | 3.25 | 3.90 | 2,604 | 491 |
| 28 | fastest | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 | 4.80 | 2,113 | -- |
| 30 | full | 0.87 | 1.04 | 1.22 | 1.39 | 1.57 | 1.74 | 2.09 | 2.43 | 2.78 | 3.13 | 3.48 | 4.17 | 2,604 | 340 |
| 30 | fastest | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 | 4.80 | 2,264 | -- |
| 32 | full | 0.93 | 1.11 | 1.30 | 1.48 | 1.67 | 1.86 | 2.23 | 2.60 | 2.97 | 3.34 | 3.71 | 4.45 | 2,604 | 189 |
| 32 | fastest | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 | 4.80 | 2,415 | -- |
| 34 | full | 0.99 | 1.18 | 1.38 | 1.58 | 1.77 | 1.97 | 2.37 | 2.76 | 3.15 | 3.55 | 3.94 | 4.73 | 2,604 | 38 |
| 34 | fastest | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 | 4.80 | 2,566 | -- |
| 35 | full | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 35 | fastest | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |